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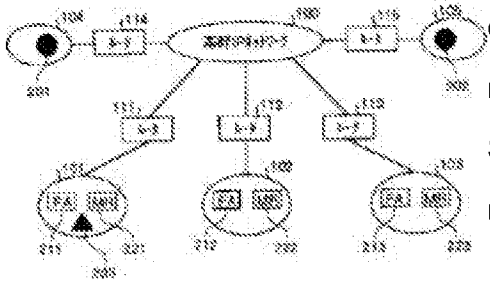
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(54) **MULTICAST COMMUNICATION METHOD**

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a multicast communication method capable of realizing efficient IP multicast communication even in an IP mobility environment.



SOLUTION: A transmission host 202 transmits multicast data to a multicast group as a multicast IP datagram including an UDP frame. A mobile host 203 registers a multicast group made to correspond to the host 203, a self-IP address, etc., in the multicast router 221 of a subnetwork

101 where the host 203 itself is located as registration information. The router 221 transfers the multicast data included in the multicast IP datagram as a unicast IP datagram including a TCP frame on the basis of the registration information registered in the router 221 in the case of receiving the multicast IP datagram.

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CLAIMS

[Claim(s)]

[Claim 1] In a multicast communication method of performing multi-cast-data transmission from a transmission host to two or more receiving hosts via a subnetwork connected mutually, said transmission host, Multi cast data are transmitted as a multicasting IP datagram which contained the UDP (User Datagram Protocol) frame in a multicast group, Said receiving hosts to a multicast router of a subnetwork in which the receiving hosts concerned are located. A multicast group matched with the receiving hosts concerned, IP (Internet Protocol) address of self, etc. are registered as said receiving hosts' registration information, When said multicast router receives said multicasting IP datagram, Receiving hosts who become the destination based on said registration information registered into the multicast router concerned are determined, To receiving hosts who determined, multi cast data contained in said multicasting IP datagram, A multicast communication method transmitting as a unicast IP datagram having contained the TCP (Transmission Control Protocol) frame.

[Claim 2] A multicast communication method according to claim 1, wherein said transmission host adds a sequence number of multi cast data contained in the multicasting IP datagram concerned to said multicasting IP datagram which transmits.

[Claim 3] Said receiving hosts are move hosts who move between said subnetworks, When the move host concerned moves to the 2nd subnetwork from the 1st subnetwork, As opposed to the 2nd multicast router belonging to said 2nd subnetwork, Transmit and a message for requiring registration with a multicast group matched with the move host concerned, and a self IP address said message, A multicast communication method according to claim 1 or 2 by which a demand which transmits datagram addressed to said move host currently held at the 1st multicast router concerned to said 2nd multicast router being shown to said 1st multicast router.

[Claim 4] Said move host a registration message which stored said registration information of the move host concerned, and information, including an IP address of

a multicast router, etc., with the present position information, Transmit to a foreign agent of said subnetwork and said foreign agent, While transmitting the new registration message which received said registration message and removed said registration information from the registration message concerned to a home agent, A multicast communication method according to claim 3 registering said registration information into a multicast router determined based on an IP address of said multicast router.

[Claim 5]A multicast communication method according to claim 3 or 4 characterized by registering said registration information to a multicast router of a subnetwork after movement with registration of the present position information when said move host moves between subnetworks.

[Claim 6]Said receiving hosts or a move host to said multicast router with said registration information. Register a reference value of communication quality over multi cast data received in the multicast router concerned, and said multicast router, A multicast communication method of any one description of the Claims 1-5 which measure said communication quality when said multi cast data are received, and are characterized by discarding multicasting which received when measured communication quality is less than said reference value.

[Claim 7]Said receiving hosts or a move host adopts permission fluctuation time as a reference value of said communication quality, and said multicast router, While memorizing receiving time at the time of receiving said multi cast data, A multicast communication method according to claim 6 discarding multicasting which received when difference of the receiving time concerned and receiving time memorized on the occasion of reception of the last multi cast data is calculated and calculated difference exceeds said permission fluctuation time.

[Claim 8]Said receiving hosts or a move host adopts permission fluctuation time as a reference value of said communication quality, and said transmission host, Add a time stamp value to said multicasting IP datagram, transmit to it, and said multicast router, When multi cast data of said multicasting IP datagram are received, while memorizing air time shown with said time stamp value, A multicast communication

method according to claim 6 discarding multicasting which received when difference of the air time concerned and air time memorized on the occasion of reception of the last multi cast data is calculated and calculated difference exceeds said permission fluctuation time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention the move host who can move between subnetworks while communicating about the multicast communication method which can be considered as receiving hosts, It is related with the multicast communication method of performing transfer control of multicasting IP (Inetnet Protocol) datagram for the move host to move between multicast routers, and receive multi cast data especially.

[0002]

[Description of the Prior Art]In the extensive network built by two or more subnetworks being connected mutually, as a means for transmitting the art for realizing multicast communication, i.e., the same data, to two or more specific receiving hosts, IETF (Internet Engineering Task Force: Internet technique standardization committee) is considering adoption of an IP multicast.

[0003]For example, management of the receiving hosts who participate in multicast communication, In the above-mentioned IETF, it is carried out according to IGMP (Internet Group Management Protocol) exhibited as official document RFC(Request for Comment) 1112. According to this IGMP, the receiving hosts who participate in multicast communication, It is supposed that the identifier (multicast group address) of the multicast group which requires reception will be registered to the multicast router for providing multicast communication in the subnetwork in which the receiving hosts are located.

[0004]However, in the communication method of an IP multicast using the Internet Protocol (IP is called hereafter) in the basis of the above-mentioned IGMP, service of a best effort type is assumed and resending of the datagram mistaken at the time of data transfer is not taken into consideration. Therefore, it is suitable for the wire communication with a circuit bit error rate low [the communication method of this IP multicast], and a low possibility that the mistaken datagram will be transmitted to receiving hosts. However, when the move host connected to a network by a radio channel turns into receiving hosts of a multicasting IP datagram. Application needs to resend datagram to reception of the mistaken datagram from having a high circuit bit error rate compared with a section of wire line between that the feature of the transmission line of a section of wire line and the feature of the transmission line between non-railroad sections differ remarkably, and a non-railroad section.

[0005]Then, as a multicast communication system in consideration of resending of the mistaken datagram, The method of performing request sending is known for returning NAK (Negative Acknowledgement: negative acknowledge) which described the number of the datagram which the receiving hosts who detected the error mistook to the transmitting station as the response in receiving datagram.

[0006]As a multicast communication system in consideration of resending of the datagram which made the mistake in being such, the "radio multicast data transfer method" is indicated by JP,H11-46161,A, for example. According to this the "radio multicast data transfer method", when a transmitting station performs multi-cast-data transmission, grouping of the receiving station group is carried out in the offices which can be transmitted and received mutually, and it elects one representative station at a time from each group.

[0007]And a transmitting station polls to each group after transmitting a series of multi cast data, ACK (Acknowledgement: positive acknowledge) is made to reply only a representative station, Other receiving stations in a group monitor the response which the representative station replied, only when there is a demand about resending, judging from the received result of a local station, NAK is replied to a transmitting station, and a transmitting station resends only the data frame demanded when NAK was replied. And when polling is resumed and only ACK is replied after the end of resending, the next group is polled, and a transmitting station completes multi-cast-data transmission, when ACK is replied from the last group.

[0008]Thereby, it is enabling multi-cast-data transmission with high efficiency by shortening of the time for performing the confirmation of receipt, the above-mentioned "radio multicast data transfer method" providing high reliability.

[0009]On the other hand, the network which supports the move host who can move between subnetworks is known, communicating. For example, RFC2002 currently exhibited in the above-mentioned IETF is supporting "IP mobility." In the IP mobility network by this RFC2002. The special agent who the node called the agent for caring for a move host is arranged, and is called a home agent to the subnetwork which supports a move host to each move host is defined.

[0010]And each move host certainly registers the present position information to the above-mentioned home agent. A move host's position information is registered also into the agent (called a foreign agent) of the subnetwork which carries out a current position. Each move host has an eternal identifier (IP address) independent of the

present position, and is managed by the home agent using this identifier.

[0011]Drawing 10 is a figure showing the outline composition of such an IP mobility network. The IP mobility network shown in drawing 10 has IP network 901 used as a trunk-line data service network, and the subnetworks 902, 903, and 904.

The case where especially the move host 909 moves to the subnetwork 904 from the subnetwork 903 is shown.

Therefore, in drawing 10, the move host 909 registers the present position information into the foreign agent 906 in the subnetwork 903 which is carrying out the current position to the home agent 905, and registers it into the foreign agent 907 after movement.

[0012]As one method which applies the multicast communication mentioned above to the network which provides IP mobility as shown in drawing 10 here, The logical channel called a bidirectional tunnel between each move host's home agent and each move host is prepared, and there is a method (the transmission participating method) of encapsulating and transmitting a multicast packet to a unicast packet.

[0013]There is also a way (the direct participating method) a move host receives a multicast packet directly with the same gestalt as a fixed host as other methods in a movement destination. In this method, a move host registers the identifier (multicast group address) of the multicast group which requires reception to the multicast router located in the subnetwork of a movement destination.

[0014]"The move host's multicast communication method" is indicated by the gazette of JP,H10-243010,A as the multicast communication method which combined the above-mentioned transmission participating method and the participating method directly. According to this "the move host's multicast communication method", according to the character of a multicast group, the direct participating method and the indirect participating method are used properly appropriately, and intervention to the multicast group of a move host with participating qualification is enabled.

[0015]

[Problem(s) to be Solved by the Invention]However, although decline in data

transmission efficiency is prevented to the radio multi-cast-data transmission in the area which a transmitting station covers by the "radio multicast data transfer method" of an indication to above-mentioned JP,H11-46161,A, In the network with which a multicast router and an IP network intervene between a transmission host and receiving hosts, there is a problem that decline in data transmission efficiency is unavoidable. In each multicast communication method which, on the other hand, supports the IP mobility mentioned above, the problem that the reduction effect of the traffic which is a merit of multicast communication is spoiled arises in the multicast communication by the above-mentioned direct participating method first.

[0016]In the multicast communication by the above-mentioned transmission participating method. When a move host moves between subnetworks, The problem that the multicasting IP datagram transmitted between the time which processing of registration of the position information after movement, the registration to a multicast router, etc. is needed, and such processing takes to a move host by the subnetwork of a movement destination is unreceivable arises.

[0017]Although how to restrict intervention of the move host who doubled with the character of the multicast group is shown by "the move host's multicast communication method" of the indication to above-mentioned JP,H10-243010,A, data transmission efficiency is not described at all.

[0018]On each multicast communication method which supports such IP mobility, and in a move host, The information for managing the information for managing mobility and the registration to a multicast group had to be transmitted and received in the separate IP datagram, and the problem of causing waste of a circuit band has arisen.

[0019]Since detection of the move host having moved the subnetwork and detection of the multicast router needed with the movement are performed independently, there is a problem of taking time for a move host to detect movement between multicast routers. Also when communicating under the application severely demanded from delay on the other hand rather than reliable data transfer, such application, When the multicasting IP datagram which has the delay beyond fixed

time is transmitted to a move host, in order to discard the IP datagram which received, resending of an IP datagram is needed and this poses a problem of waste of a circuit band.

[0020]Also in the IP mobility environment where the move host who was made in order that this invention might solve the above-mentioned problem, and is connected to a network via a radio channel moves during communication between subnetworks, It aims at obtaining the multicast communication method which can realize efficient IP multicast communication.

[0021]

[Means for Solving the Problem]If it is in a multicast communication method concerning this invention in order to solve SUBJECT mentioned above and to attain the purpose, In a multicast communication method of performing multi-cast-data transmission from a transmission host to two or more receiving hosts via a subnetwork connected mutually, said transmission host, Multi cast data are transmitted as a multicasting IP datagram which contained the UDP (User Datagram Protocol) frame in a multicast group, Said receiving hosts to a multicast router of a subnetwork in which the receiving hosts concerned are located. A multicast group matched with the receiving hosts concerned, IP (Internet Protocol) address of self, etc. are registered as said receiving hosts' registration information, When said multicast router receives said multicasting IP datagram, Determine receiving hosts who become the destination based on said registration information registered into the multicast router concerned, and multi cast data contained in said multicasting IP datagram to receiving hosts who determined, It transmits as a unicast IP datagram having contained the TCP (Transmission Control Protocol) frame.

[0022]According to this invention, a multicast router receives a multicasting IP datagram which adopted UDP as IP data, is once accumulated, and receives receiving hosts, Since the multicasting IP datagram is transmitted as a unicast IP datagram which adopted TCP as IP data, data communications between multicast routers can be performed according to a TCP procedure with receiving hosts.

[0023]If it is in a multicast communication method concerning the next invention, in the above-mentioned invention, said transmission host adds a sequence number of multi cast data contained in the multicasting IP datagram concerned to said multicasting IP datagram which transmits.

[0024]According to this invention, since a sequence number is added to a multicasting IP datagram which a transmission host transmits, in receiving hosts, learning of the loss of a multicasting IP datagram, etc. can be carried out by detecting this sequence number.

[0025]If it is in a multicast communication method concerning the next invention, He is a move host to whom said receiving hosts move between said subnetworks in the above-mentioned invention, When the move host concerned moves to the 2nd subnetwork from the 1st subnetwork, As opposed to the 2nd multicast router belonging to said 2nd subnetwork, Transmit and a message for requiring registration with a multicast group matched with the move host concerned, and a self IP address said message, A demand which transmits datagram addressed to said move host currently held at the 1st multicast router concerned to said 2nd multicast router is shown to said 1st multicast router.

[0026]When according to this invention receiving hosts are move hosts and move during communication of data between subnetworks, Since a multicast router of a movement destination requires transmission of datagram transmitted to former addressing to a multicast router from a former multicast router, data loss accompanying a move host's movement can be reduced.

[0027]If it is in a multicast communication method concerning the next invention, Said move host in the above-mentioned invention with the present position information. A registration message which stored said registration information of the move host concerned, and information, including an IP address of a multicast router, etc., Transmit to a foreign agent of said subnetwork and said foreign agent receives said registration message, While transmitting the new registration message which removed said registration information from the registration message concerned to a home agent, Said registration information is registered

into a multicast router determined based on an IP address of said multicast router.

[0028]When receiving hosts are move hosts according to this invention, the present position information in a registration message for registering with a mobility agent (a home agent and a foreign agent). Since information which requires reception of multi cast data to a multicast router is included, A message which requires reception of multi cast data can be performed to a message and a multicast router for registering position information into a home agent and a foreign agent by one registration message.

[0029]If it is in a multicast communication method concerning the next invention, In the above-mentioned invention, when said move host moves between subnetworks, said registration information is registered to a multicast router of a subnetwork after movement with registration of the present position information.

[0030]When a move host who is receiving hosts detects movement between subnetworks according to this invention, with re-registration of the present position information. Since registration information is directly registered to a multicast router after movement, it becomes possible to re-register a multicast group of a multicast router after movement, etc. quickly.

[0031]If it is in a multicast communication method concerning the next invention, In the above-mentioned invention, said receiving hosts or a move host to said multicast router with said registration information. A reference value of communication quality over multi cast data received in the multicast router concerned is registered, Multicasting which received is discarded when it measures said communication quality when said multicast router receives said multi cast data, and measured communication quality is less than said reference value.

[0032]Since according to this invention a reference value of communication quality over a multicast group etc. which are contained in registration information is also collectively registered when receiving hosts or a move host registers registration information into a multicast router, A multicast router becomes possible [transmitting only multi cast data which fulfill a reference value of communication quality in this the bottom to receiving hosts].

[0033]If it is in a multicast communication method concerning the next invention, While said receiving hosts or a move host adopts permission fluctuation time as a reference value of said communication quality and said multicast router memorizes receiving time at the time of receiving said multi cast data in the above-mentioned invention, Multicasting which received is discarded, when difference of the receiving time concerned and receiving time memorized on the occasion of reception of the last multi cast data is calculated and calculated difference exceeds said permission fluctuation time.

[0034]Since a multicast router performs abandonment judgment of multicasting by a detection result of the above-mentioned communication quality based on receiving time of a continuous multicasting IP datagram according to this invention, A multicasting IP datagram received by having a time delay more than fixed is detectable.

[0035]If it is in a multicast communication method concerning the next invention, In the above-mentioned invention, said receiving hosts or a move host adopts permission fluctuation time as a reference value of said communication quality, Said transmission host adds a time stamp value to said multicasting IP datagram, and transmits to it, When said multicast router receives multi cast data of said multicasting IP datagram, while it memorizes air time shown with said time stamp value, Multicasting which received is discarded, when difference of the air time concerned and air time memorized on the occasion of reception of the last multi cast data is calculated and calculated difference exceeds said permission fluctuation time.

[0036]According to this invention, a time stamp value is added to a multicasting IP datagram transmitted by transmission host, Since a multicast router performs abandonment judgment of multicasting by a detection result of the above-mentioned communication quality based on air time shown in the above-mentioned time stamp value, a multicasting IP datagram transmitted by having a time delay more than fixed is detectable.

[0037]

[Embodiment of the Invention]Below, the embodiment of the multicast communication method concerning this invention is described in detail based on Drawings. This invention is not limited by this embodiment.

[0038]embodiment 1. -- the multicast communication method concerning Embodiment 1 is explained first. Drawing 1 is a figure showing the network composition for explaining the multicast communication method concerning Embodiment 1, and shows the network which performs multi-cast-data transmission from a transmission host to two or more receiving hosts via the subnetwork connected especially mutually.

[0039]The network shown in drawing 1 has basic IP network 100 and the subnetworks 101, 102, 103, 104, and 105. And the subnetworks 101, 102, 103, 104, and 105 are connected to basic IP network 100 via the routers 111, 112, 113, 114, and 115, respectively. The subnetworks 101, 102, and 103 have the multicast routers 221, 222, and 223 with the foreign agents 211, 212, and 213, respectively. The subnetwork 104 has the home agent 201 and the subnetwork 105 has the transmission host 202 who transmits multi cast data.

[0040]Especially this Embodiment 1 explains the multicast communication method about the case where between each subnetwork is made into a movable move host for receiving hosts, and shows the state where the move host 203 was located in the subnetwork 101, as an initial state in drawing 1. The home agent who provides the move host 203 with IP mobility is the home agent 201 located in the subnetwork 104.

[0041]The move host 203 receives the multicast router 221 here, When the received multi cast data are the things to multicast group IPmulticastAddress-1, it has registered transmitting the multi cast data to the move host 203 of self. And the multicast router 221 holds the entry table showing the register state of these multi cast data. Drawing 2 is a figure showing the entry table held at the multicast router 221.

[0042]In [as shown in drawing 2, the entry table comprises an item of the identifier of a multicast group, the registration host, and the attribute, and] the

above-mentioned state, In order, multicast group IPmulticastAddress-1, the move host 203, and reserve are registered into each item. On a network, a registration host is registered here as an IP (Internet Protocol) address which is a peculiar identifier.

[0043]In this state, the transmission host 202 performs multiple address dispatch, i.e., IP multicast transmission, by making the above-mentioned multi cast data addressed to multicast group IPmulticastAddress-1 into a multicasting IP datagram. This multicasting IP datagram is transmitted like the conventional IP multicast as a frame which used UDP (User Datagram Protocol) for IP data. And the multicast router 221 will accumulate the data division in the UDP frame in the buffer in the multicast router 221, if the above-mentioned multicasting IP datagram addressed to multicast group IPmulticastAddress-1 is received.

[0044]It continues, and the multicast router 221 includes the data division accumulated in the buffer in the TCP (Transmission Control Protocol) frame, and transmits it to the move host 203 as a unicast IP datagram which used TCP for IP data. That is, the data communications between the multicast router 221 and the move host 203 are performed under a TCP procedure, and recovery over a data error or a data loss can also be performed according to the TCP procedure. Thereby, recovery of data which was described above can be performed only using the communication path which connects between the move hosts 203 with the multicast router 221.

[0045]In drawing 1, although the foreign agent and multicast router in each subnetwork are shown as another device, the device of one which has these each function can also be used.

[0046]According to the multicast communication concerning Embodiment 1, as explained above. Since the multicast router 221 transmits the multi cast data which the transmission host 202 transmitted as an UDP frame to the move host 203 who becomes an address as a unicast IP datagram of the TCP frame, It becomes possible to perform reliable data transfer, without making ** which performs data recovery etc. by a TCP procedure, and wasting the multicast router 221 and other

network resources other than between the move hosts 203.

[0047]The multicast communication method which starts embodiment 2. Ranking next at Embodiment 2 is explained. Although the transmission host 202 described the example which transmits multi cast data as a data division of the UDP frame in the above-mentioned Embodiment 1 according to the conventional IP multicast, In the multicast communication method concerning Embodiment 2, it is characterized by the transmission host's 202 giving a sequence number to the multi cast data to transmit, and transmitting the information on the sequence number with multi cast data.

[0048]In the conventional IP, for example, IP format of the Internet Protocol version 4 generally used now, drawing 3, It is a figure showing the multi-cast-data move format which provided the field which stores the above-mentioned sequence number in the UDP frame in IP data. In the multi-cast-data move format shown in drawing 3, having adopted UDP as a protocol used for IP data is recognized by setting 17 which shows UDP as the protocol number field in an IP header. And between the data field which UDPport-1 which shows a destination port is set as the UDP header in this UDP frame, and stores that UDP header, and the field which stores multi cast data, The field which stores the sequence number given to the above-mentioned multi cast data is provided.

[0049]Thus, since the field which stores like TCP the sequence number which identifies multi cast data is provided into the UDP frame, When receiving hosts receive the multi cast data shown in drawing 3, it becomes possible by detecting the sequence number in the UDP frame to detect loss of an IP datagram easily. In order to correspond to drain of an IP address, as an inheritor of the present IP (IPv4:IP version 4), IPv6 (Internet Protocol version 6) is developed and the above-mentioned concept of sequence number grant can be applied also in the format of this IPv6.

[0050]Drawing 4 is a figure showing the multi-cast-data move format which stored the above-mentioned sequence number in the reception destination option header of an IPv6 format. In the IPv6 format, the option header is provided in the field of the preceding paragraph of IP data, It can use for fragmentation, attestation, a code,

path control (the router to pass is specified), a relay option (it is made to process for every router to pass), a reception destination option (processing is performed when an address is reached), etc.

[0051]Here, as shown in drawing 4, an option header is used as a reception destination option, and the sequence number above-mentioned in especially the field is held. Thereby, also to the multi cast data of the IPv6 format shown in drawing 4, receiving hosts can detect the sequence number in the UDP frame, and the detection of loss of an IP datagram of them is attained.

[0052]According to the multicast communication method concerning Embodiment 2, as explained above. Since the field which stored the sequence number over multi cast data is provided in the IP multicast data which includes the UDP frame as IP data, When the receiving-hosts side receives this IP multicast data, loss of an IP datagram, etc. can be detected by detecting a sequence number. According to this detection, reception of an IP datagram can be made into a positive thing by performing request sending of an IP datagram to the transmission host side.

[0053]The multicast communication method which starts embodiment 3. Ranking next at Embodiment 3 is explained. In Embodiments 1 and 2 mentioned above, when the move host 203 was located in the subnetwork 101, described the example which receives multi cast data, but. By the multicast communication method concerning Embodiment 3, the case where the move host 203 moves from the subnetwork 101 during reception of multi cast data at the subnetwork 102 is explained.

[0054]Drawing 5 is an explanatory view for explaining ***** of communication by the multicast communication method concerning this Embodiment 3. In drawing 5, the move host 203 recognizes first that self moved into the subnetwork 102 by receiving the agent ad message 41 from the foreign agent 212 in the subnetwork 102. Under the present circumstances, the move host 203 registers the present position information via the foreign agent 212 to the home agent 201 further. Namely, the move host 203 transmits the registration request 42 included the present position information to the home agent 201, as shown in drawing 5, The

registration response 43 which shows completion of registration via the foreign agent 212 from the home agent 201 is received.

[0055]The move host 203 receives the multicast router 222 belonging to the subnetwork 102 after movement with movement to the subnetwork 102 from the subnetwork 101, The purport that the multi cast data addressed to multicast group IPmulticastAddress-1 are transmitted to the move host 203 of self, The multicasting registration message 44 indicated to be an identifier (IP address of the multicast router 221) of the multicast router 221 belonging to the subnetwork before movement is transmitted.

[0056]If the above-mentioned multicasting registration message 44 is received, the multicast router 222, According to the multicasting registration message 44, the data transfer request message 45 which showed that the multi cast data which should be transmitted to the move host 203 were transmitted to the multicast router 222 is transmitted to the multicast router 221.

[0057]If the above-mentioned data transfer request message 45 is received, the multicast router 221, According to the transfer-request message 45, the multi cast data accumulated in order to transmit to the move host 203 are transmitted to the multicast router 222 as unicast IP datagram 46 which used TCP for IP data. If above-mentioned unicast IP datagram 46 is received, the multicast router 222 will be transmitted to the move host 203 as IP datagram 47, after it changes a transmission destination address into the move host 203.

[0058]According to the multicast communication method concerning Embodiment 3, as explained above. [when the move host 203 moves to the subnetwork 102 from the subnetwork 101], By requiring the data transfer transmitted to the multicast router 221 belonging to the subnetwork 101 before the multicast router 222 belonging to the subnetwork 102 after movement moving. While being able to transmit the data transmitted to the subnetwork 101 before movement to the subnetwork 102 after movement, the transmission host 202, The multi cast data 48 can be transmitted without being conscious of these move host's 203 movement, and it becomes possible to avoid the data loss accompanying the move host 203

moving between subnetworks.

[0059]The multicast communication method which starts embodiment 4. Ranking next at Embodiment 4 is explained. In Embodiments 1-3 mentioned above, the move host 203, The registration request for registering the present position information into the home agent 201, The multicasting registration message which showed that the multi cast data of multicast group IPmulticastAddress-1 were transmitted to the move host 203 at the multicast router 221 or 222, Although each had transmitted to arbitrary timing, In the multicast communication method concerning Embodiment 4. It replaces with the above-mentioned registration request and multicasting registration message, It is characterized by using the registration message which stored information, including the IP address of the identifier (multicast group address) of a multicast group, and a move host, the IP address of a multicast router, etc., in the multicast router.

[0060]Drawing 6 is a figure showing the format with the above-mentioned extended data for multicasting of a registration message. In the format of the registration message shown in drawing 6. The data field specified by RFC2002 which adopted UDP as IP data and was described above in this UDP frame following the UDP header, The field of the extended data for multicasting which stored the above-mentioned information, including a multicast group address, a move host's IP address, the IP address of a multicast router, etc., is provided.

[0061]Drawing 7 is an explanatory view for explaining ***** of communication by the multicast communication method concerning this Embodiment 4. In drawing 7, first the foreign agent 211, If the registration message 61 shown in drawing 6 is received from the move host 203, The registration message 62 which removed the extended data part above-mentioned from the registration message which received for multicasting, i.e., a registration request, is transmitted to the home agent 201. And if the above-mentioned registration message 62 is received, the home agent 201 will perform registration processing of the move host 203 according to the registration message 62, and will transmit the registration response 64 to the move host 203.

[0062]The multicasting registration message 63 which the foreign agent 211 created from the extended data for multicasting, Based on the IP address of the multicast router shown in the extended data for multicasting, it transmits to the multicast router 221. The multicast router 221 will perform registration processing of the move host 203 according to the multicasting registration message 63, if the above-mentioned multicasting registration message 63 is received.

[0063]Although the above-mentioned format of the registration message followed RFC2002 which supports "IP mobility", The message format transmitted to the multicast router 221 from the foreign agent 211 is the message according to RFC1112, i.e., an IGMP message.

[0064]The IGMP message transmitted from a multicast router, It is also possible to be directly transmitted to the move host 203 from the multicast router 221, and, When transmitted to the foreign agent 211 from the multicast router 221, He is able for the foreign agent 211 to include the contents of the IGMP message in the extended data for multicasting of the registration response 64 transmitted by the move host 203 from the home agent 201, and to transmit them to the move host 203.

[0065]According to the multicast communication method concerning Embodiment 4, as explained above. The registration request for registering the move host's 203 present position information into the multicast router 221 which belongs to the subnetwork after movement with the home agent 201, Since transmission of the one registration message 61 has realized, It becomes possible to reduce the overheads of an IP header when the move host 203 transmits two or more registration requests, and waste of the circuit band between the move host 203 and the foreign agent 211 and reduction of a move host's processing load are attained.

[0066]It becomes possible to combine in "IP mobility" procedure of managing the move host's 203 present position information for change of the multicast router used as a registration destination produced with movement, and to carry out, when the move host 203 detects change of position information.

[0067]The multicast communication method which starts embodiment 5. Ranking next at Embodiment 5 is explained. In Embodiment 4 mentioned above, in the

registration message 61 for the move host 203 to register the present position information into the home agent 201. Although the example which adds the registration information of the move host 203 to the multicast router 221, including the IP address of a multicast group, etc., was described, In the multicast communication method concerning Embodiment 5, when the move host 203 registers the registration information of the move host 203 of self into the multicast router 221, it is characterized by adding the information which showed the communication quality over multi cast data.

[0068]Drawing 8 is the flow chart which showed the communications processing based on detection of the information on the above-mentioned communication quality in the multicast communication method concerning Embodiment 5, Processing by the multicast router at the time of setting up the permission fluctuation time which means the receiving interval of the data which continued as communication quality especially is shown.

[0069]First, in drawing 8, reception of a multicasting IP datagram of the multicast router in the subnetwork in which a move host is located will investigate whether it is no for whether communication quality, i.e., permission fluctuation time, is already registered by the move host (Step S301). In Step S301, as communication quality, when permission fluctuation time is not registered, a series of processings by a multicast router are ended, and permission fluctuation time is registered if needed. On the other hand, in Step S301, when permission fluctuation time is registered as communication quality, a multicast router memorizes as Trec1 the time which received the multicasting IP datagram (Step S302). And the difference Tdiff of time Trec0 memorized as receiving time before is calculated (Step S303), and it replaces by the value which time Trec1 which described time Trec0 above shows (Step S304).

[0070]And Tdiff calculated in Step S303 investigates whether it is over Tallow which shows permission fluctuation time (Step S305). In Step S305, when the difference Tdiff is over the permission fluctuation time Tallow, the multicasting IP datagram which received is discarded (Step S306). On the other hand, in Step S305, when

the difference T_{diff} is not over the permission fluctuation time T_{allow} , the multicasting IP datagram which received is transmitted to a move host according to the contents and receiving hosts' registration information (Step S307).

[0071] Thus, a multicast router, for example a move host, When moving during communication between subnetworks and the receiving interval (reception fluctuation time) of the received data which continued temporarily becomes large with the registration of position information and the change of a multicast router accompanying the movement, the multi cast data in that case can be discarded.

[0072] Although the multicast router used the difference of the receiving time of the multicasting IP datagram which receives continuously as information on communication quality in the above-mentioned example, It is also possible to replace with receiving time and to use the time stamp value added to the multicasting IP datagram transmitted by the transmission host. For example, when the field which stores a time stamp value is established in multi cast data as shown in drawing 3 and the transmission host 202 transmits a multicasting IP datagram to them, it is set as the field of the time stamp value which described the time of the transmission above.

[0073] Drawing 9 is a figure showing the multi-cast-data move format in which the field of the above-mentioned time stamp value was established. In the multi-cast-data move format shown in drawing 9, the field of the above-mentioned time stamp value is provided between the field which stores the sequence number explained in Embodiment 2, and the field which stores multi cast data.

[0074] Since a receiving interval discards the multicasting IP datagram beyond reception fluctuation time according to the multicast communication method concerning Embodiment 5 as explained above, While becoming effective to the application which cannot permit such reception fluctuation time in particular, waste of the circuit band between multicast routers is avoidable with a move host.

[0075]

[Effect of the Invention] As mentioned above, according to this invention, a multicast router receives the multicasting IP datagram which adopted UDP as IP data, is once

accumulated, and receives receiving hosts as explained, Since the multicasting IP datagram is transmitted as a unicast IP datagram which adopted TCP as IP data, In the data communications between receiving hosts and a multicast router, it becomes possible to perform data recovery according to a TCP procedure, etc., and the effect that the reliability of multicast communication can be raised is done so.

[0076] Since a sequence number is added to the multicasting IP datagram which a transmission host transmits according to the next invention, It enables receiving hosts to detect the loss of the multicasting IP datagram on a circuit easily based on this sequence number, Based on this detection, request sending etc. can be performed to a transmission host, and the effect that the reliability of multicast communication can be raised more is done so.

[0077] When according to the next invention receiving hosts are move hosts and move during communication of data between subnetworks, Since transmission of the datagram which the multicast router of a movement destination holds to a former multicast router is required, the effect that the data loss accompanying a move host's movement can be reduced is done so.

[0078] When receiving hosts are move hosts according to the next invention, the present position information in the registration message for registering with a mobility agent (a home agent and a foreign agent). Since the information which requires the reception of multi cast data to a multicast router is included, The message which requires the message for registering position information into a home agent and a foreign agent and the reception of multi cast data to a multicast router can be performed by one registration message, The effect that the traffic between the move host by duplication of the overhead of an IP header and a foreign agent can be reduced is done so.

[0079] When the move host who is receiving hosts detects movement between subnetworks according to the next invention, with re-registration of the present position information. Since registration information is directly registered to the multicast router after movement, the effect of becoming possible to perform quickly re-registration of the multicast group to the multicast router after movement, etc. is

done so.

[0080]Since according to the next invention the reference value of the communication quality over the multicast group etc. which are contained in registration information is also collectively registered when receiving hosts or a move host registers registration information into a multicast router, The multicast router can transmit only the multi cast data which fulfill the reference value of the above-mentioned communication quality to receiving hosts, and the effect of becoming possible to reduce the traffic between multicast routers with receiving hosts etc. is done so.

[0081]Since a multicast router performs abandonment judgment of multicasting by the detection result of the above-mentioned communication quality based on the receiving time of the continuous multicasting IP datagram according to the next invention, The multicasting IP datagram received by having a time delay more than fixed can be detected, and the effect that the multi cast data to discard can be sorted out easily is done so.

[0082]According to the next invention, a time stamp value is added to the multicasting IP datagram transmitted by the transmission host, Since a multicast router performs abandonment judgment of multicasting by the detection result of the above-mentioned communication quality based on the air time shown in the above-mentioned time stamp value, The multicasting IP datagram transmitted by having a time delay more than fixed can be detected, and the effect that the multi cast data to discard can be sorted out easily is done so.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a figure showing the network composition for explaining the multicast communication method concerning Embodiment 1.

[Drawing 2] In the multicast communication method concerning Embodiment 1, it is a figure showing the entry table held at a multicast router.

[Drawing 3] It is a figure showing the multi-cast-data move format in the multicast communication method concerning Embodiment 2.

[Drawing 4] It is a figure showing other examples of the multi-cast-data move format in the multicast communication method concerning Embodiment 2.

[Drawing 5] It is an explanatory view for explaining ***** of communication by the multicast communication method concerning Embodiment 3.

[Drawing 6] the multicast communication method **** concerning Embodiment 3 -- it is a figure showing the format with the extended data for multicastings of a registration message.

[Drawing 7] It is an explanatory view for explaining ***** of communication by the multicast communication method concerning Embodiment 4.

[Drawing 8] In the multicast communication method concerning Embodiment 5, it is the flow chart which showed the communications processing based on detection of the information on the above-mentioned communication quality.

[Drawing 9] In the multicast communication method concerning Embodiment 5, it is a figure showing the multi-cast-data move format in which the field of the time stamp value was established.

[Drawing 10] It is a figure showing the outline composition of the IP mobility network in the former.

[Description of Notations]

100 A basic IP network, and 101-105 Subnetwork, 111-115 [A foreign agent and 221,222,223 / Multicast router.] A router and 201 A home agent, 202 transmission hosts, and 203 A move host and 211,212,213

[Translation done.]

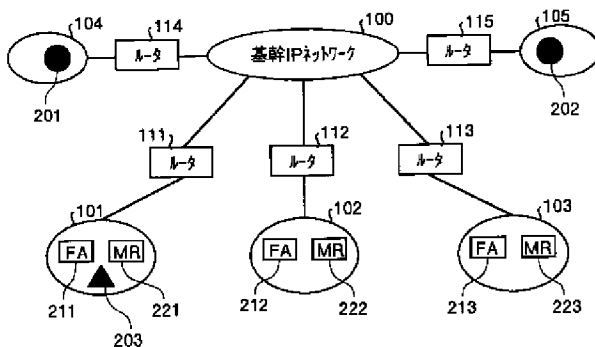
* NOTICES *

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
 - 2.**** shows the word which can not be translated.
 - 3.In the drawings, any words are not translated.
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DRAWINGS

[Drawing 1]

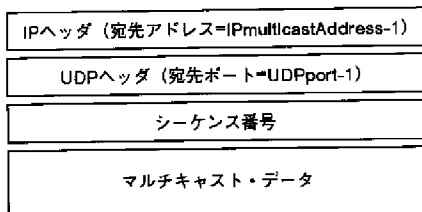


[Drawing 2]

エントリーテーブル		
マルチキャストグループの識別子	登録リスト	属性
マルチキャストグループ PmulticastAddress-1	移動リスト203	リザーブ

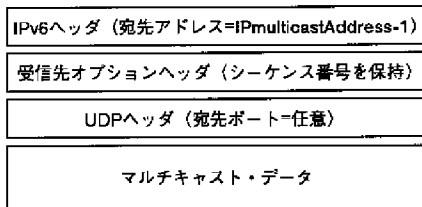
[Drawing 3]

マルチキャスト・データ転送フォーマット

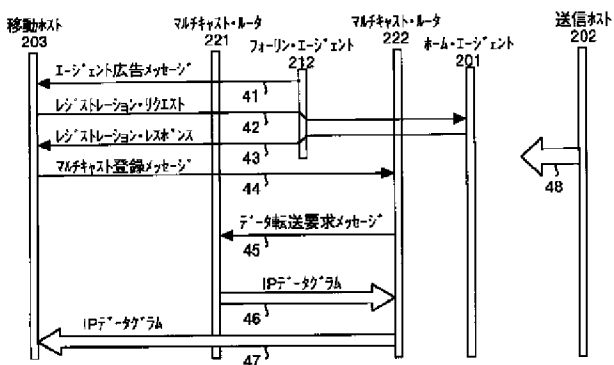


[Drawing 4]

IPv6受信先オプションヘッダによる
マルチキャスト・データ転送フォーマット

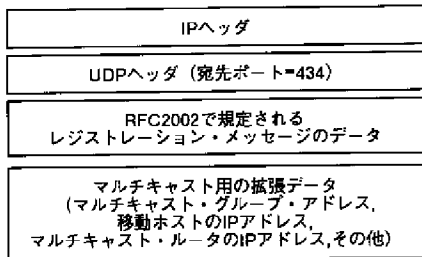


[Drawing 5]

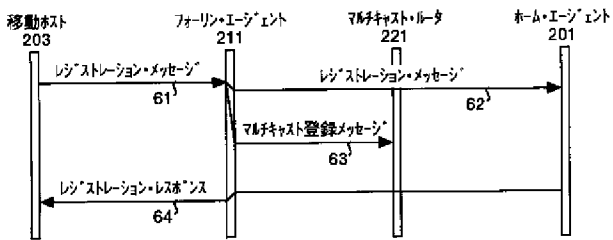


[Drawing 6]

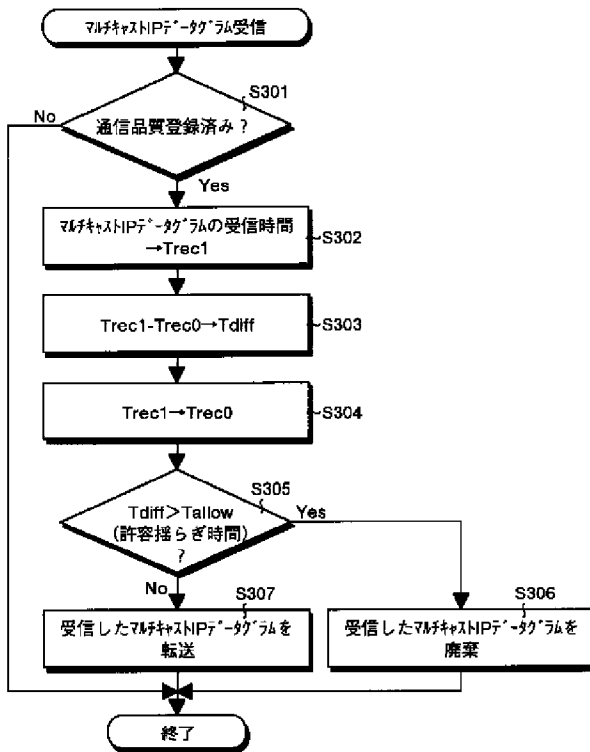
マルチキャスト用の拡張を持つ
レジストレーション・メッセージ



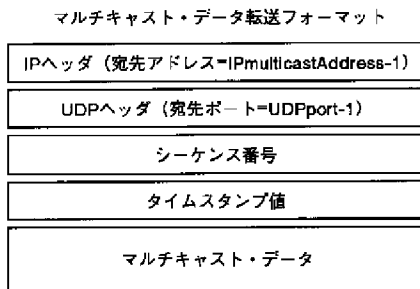
[Drawing 7]



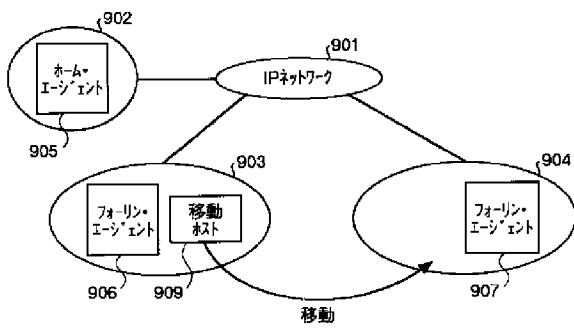
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]